



OFFICE MEMORANDUM

DATE: July 16, 1996

TO: District Engineers
District Field Engineers
District Construction Engineers
Resident/Project Engineers

FROM: Paul F. Miller
Engineer of Construction

Calvin Roberts
Engineer of Materials and Technology

**SUBJECT: JOINT CONSTRUCTION AND MATERIALS AND TECHNOLOGY
INSTRUCTIONAL MEMORANDUM 1996-H
Welding Beam End Repairs**

We have recently completed a number of projects which involved repairing heavily corroded beam ends by welding in newly fabricated partial beam end sections. Typically, the corroded beam end is cut out to match the newly fabricated partial beam section. The two pieces are welded together at the bottom flange and web by the use of full penetration butt welding. A cope hole is cut into the web just above the top of the bottom flange to provide welding access across the bottom flange and to allow an avenue for smooth stress flow around the hole. This repair technique produces a quality repair provided the requirements of our field welding specifications are enforced.

We are taking this opportunity to reiterate some of the critical requirements of our field welding specifications, the American Welding Society Bridge Welding Code D1.5 (AWS D1.5), and the repair procedure; all of which must be strictly followed and enforced to insure contract compliance and repair quality.

1. Welders must be qualified, by test, by the Department. Welder qualification by other agencies is not acceptable.
2. Welding Procedures must be written and approved by the Materials and Technology Division before field welding commences. This includes repair procedures.
3. After cutting the exiting beam end off, the web and bottom flange that were cut must be ground to the bevel shown on the plans.
4. It is very important that the contractor cut the cope hole to the dimensions shown on the plans and that they grind out all rough kerf marks and gouges. The only way to grind the cope hole smooth, as the plans require, is to use a die grinder. Flat disk grinders cannot get in the cope hole and grind to an acceptable smoothness.

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5. The surface roughness of any flame cut edge must be ground smooth. The smoothness should be about that of a blast cleaned steel surface just before painting (AWS D1.5 Section 3.2.2).
6. Once the proposed beam end is fit in place, proper joint preparation is required. Joints to be welded must be cleaned to bare metal. Web welding must be done on one side and back gouged (using an air carbon arc gouging process) on the other side to sound weld metal, the joint ground clean and welding completed. The flange to flange joint must have a backup bar and runoff tabs on the joint before welding starts (AWS D1.5 Section 3.12 and 3.13). The backup bar and runoff tabs must be removed and all surfaces ground smooth after welding is complete. Back gouging is not allowed from the other side on flange to flange welding. Over head welding of full penetration joints is not allowed.
7. All joints must be preheated with a rose-bud torch just before welding. See the Special Provision for Field Welding and Nondestructive Testing in the proposal for temperature requirements for preheat and postheat of welds.
8. After the welding is completed and before nondestructure testing, all welds must be ground smooth. This grinding helps to remove residual stresses and discontinuities and provides smooth stress flow in addition to providing a smooth clean surface for the nondestructive testing. When grinding full penetration butt welds the surface of the weld to the base metal cannot be over ground by more than 1/32-inch nor can the weld metal be built up beyond the base metal by more than 1/8-inch (AWS D1.5 Section 3.6). A flush condition is ideal.
9. A smooth continuous transition from weld metal to base metal is essential. The exiting steel may be thinner than the new because of corrosion, etc. If this is the case, additional grinding will be required, after welding, to transition the new steel and weld metal into the exiting steel. The transition must be sloped and cannot exceed one-in-ten from the weld metal to adjacent base metal.
10. Ultrasonic testing is required for all full penetration butt welds. If the butt welds are not ground to a smooth and flush condition with the base metal, the results of the ultrasonic testing will be difficult to interrupt. After the backup bar and run off tabs are removed, dye penetrant testing shall be used to inspect for surface and sub-surface cracks in the location of removal (See the Special Provision for Structural Steel and Aluminum Construction, Part I, page 14 of 27). Smooth continuous transition from weld metal to base metal is essential.

11. If fillet welds are required on the project for bearing assemblies, stiffeners, or other components, all fillet welds made in the field require magnetic particle testing, using aluminum prods, their full length.
12. If discontinuities (cracks, flaws) are detected by the nondestructive testing and welding repairs are required, the contractor is required to nondestructively retest the repaired area.

The requirements for field welding and nondestructive testing are thoroughly defined in the “Special Provision for Field Welding and Nondestructive Testing,” the “Special Provision for Structural Steel and Aluminum Construction,” the AWS D1.5 code, and in the contract plans. It is the contractor’s responsibility to qualify welders and weld procedures before field welding starts. The contractor should allow several weeks for this process since Materials and Technology Division will require time to schedule and conduct the testing needed.

If you have any questions relative to the specifications for field welding, or the procedures required to complete the welded beam end repairs, contact Steve Cook, in the Materials and Technology Division, at (517) 322-5709. Steve is also available, at your request, to attend preconstruction meetings to clarify welding requirements or to meet with construction staff at the job site as work commences.

Engineer of Construction

Engineer of Materials and Technology

MT:SJC/CD:GJB:jp

Subject Index: Welding

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